USGS NSF GRIP Opportunity

USGS Center:	Fort Collins Science Center
Project Title:	Video behaviors of bats at wind turbines in the context of fatality
Project Hypothesis or Objectives:	Industrial wind turbines used for energy production are having unanticipated and unprecedented adverse impacts on certain kinds of animals. On several different continents, bats are being found dead beneath wind turbines in vastly greater numbers than have previously been found beneath other tall, anthropogenic structures. In parts of North America and Europe, hundreds of thousands of bats are estimated to be dying each year at wind turbines. This level of fatality far exceeds any previously known human-induced stressors to these bat populations. Several bat species showing the highest susceptibility to wind turbines could be in decline and at risk of extinction due primarily to wind energy development. Available evidence suggests that certain species of bats may be attracted to wind turbines, but we currently do not understand exactly why they are so susceptible—more information is needed. However, there are few existing methods of studying small animals that fly in the dark around extremely tall structures. Over the past decade, USGS researchers have developed useful new methods of studying bat interactions with wind turbines under field conditions. In particular, the novel use of thermal-imaging surveillance cameras deployed over month-long periods helped advance understanding of how bats approach and interact with wind turbines (e.g., Cryan et al. 2014. Behavior of bats at wind turbines, PNAS 111:15126-15131). Since developing this method, USGS scientists have gathered over 10,000 hours of thermal video surveillance imagery from operating wind turbines at 4 different facilities in three states. Although much of these video data have been analyzed and reported on, we have not extracted all of the information from these unique observations due to time constraints and lack of expertise on behavioral ecology and image processing methods. Partial answers to the bat-turbine problem may still lie hidden in our existing recorded imagery. Not only can we get more information from these abundant existing data, but we can do a better job of efficiently detecting and then characterizing bat behaviors at wind turbines as part of future studies. USGS and

	research partners are currently moving toward testing methods of deterring bats from wind turbines (e.g., ultraviolet illumination) as well as looking for predictable relationships between weather or turbine operation and bat fatality. These aims will rely on us efficiently gathering and analyzing greater volumes of video data than ever before. USGS research would greatly benefit by developing a more robust framework for automatically detecting bats in the thousands of hours of resulting imagery, as well as better characterizing the way that bats behaviorally respond to wind turbines as observed with thermal surveillance video. Any developed methods will be published and shared with the greater scientific community, resource managers, and the wind energy industry.
Duration:	12 months
Internship Location:	Fort Collins, Colorado
Area of Discipline:	Behavioral ecology and computer video image processing
Expected Outcome:	With guidance from USGS scientists, the intern will be encouraged to produce: 1) a scientific paper better characterizing the behaviors of bats at wind turbines under a variety of situations, and 2) improved software code for finding and characterizing behaviors of bats in thermal surveillance video.
Special skills/training Required:	The intern is required to have experience conducting non-invasive, observational field studies of wild animals that focus on wildlife behavior in response to novel situations. Experience with computer coding, digital image acquisition, and automated digital image processing is desirable, but not required.
Duties/Responsibilities:	The intern would be responsible for: 1) reviewing events involving bat detections in imagery we previously recorded, 2) analyze and characterize the different behaviors observed (e.g., create an ethogram, find useful behavioral parameters to measure), and 3) develop automated image processing methods that do a better job of finding bats and identifying the different types of behaviors observed in existing and newly gathered video imagery.
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